Exploration of Telecommuting and Real Estate Demand Ramifications
A Comparison and Contrast of Various Methodologies

by

Alfred Juro Mustey Shiga

Submitted to the Department of Urban Studies and Planning
on September 27, 1996 in partial fulfillment of the requirements for the
Degree of Master of Science in Real Estate Development

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ABSTRACT

An examination of various methodologies currently being used to determine the current state of telecommuting in the United States and its ramifications on real estate demand. Includes a comparison and critique of current methodologies. Also integrates sources from perspectives traditionally disparate in order to obtain an accurate evaluation. Makes recommendations for procedures necessary for an accurate evaluation to occur. Offers evidence supporting the claim that the full extent of telecommuting is presently being underestimated. Includes comprehensive list of online telecommuting and real estate resources.

Findings were that little comprehensive data currently exists with which to gauge telecommuting's effect. However, the data available suggests that larger effects are forthcoming, yielding increasing suburbanization within areas featuring large technological infrastructure, high quality of life amenities and correct labor mix.

Thesis Supervisor: William J. Mitchell
Title: Dean, School of Architecture and Urban Planning

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Introduction

"Location, location, location," perhaps the best known axiom describing the "three" most important attributes of real estate historically. But given the meteoric advancements of technology and telecommunications during recent history, have caused many to speculate that this saying does not contain as much clarity nor truth as it did in the past.

There has been much said recently about the effect telecommuting will, or by some accounts *has* had on one's ability to work, live and play. These changes have helped to foster much speculation about the effect that telecommuting will have on real estate demand. But regardless of the *hype* that surrounds this subject. It is apparent that traditional viewpoints, thoughts and perceptions of location and physical space are no longer as crystalline as they once were. Especially influential are the applications and appliances which provide communication links via wide area networks (WAN) such as the Internet as well as the recent growth of Intranet technologies (essentially Internet accessible resources specifically for internal firm use).

"Your own address is not pinned to a place; it is simply an access code with some associated storage space, to some computer located somewhere on the Net.,"[1] Mitchell's statement helps to highlight the potential ramifications for those in the real estate industry and the workers / companies that consume real estate space. This thesis attempts to summarize current trends of telecommuting and in the process sort the plethora of conjecture that currently surrounds this subject.

To further emphasize this point I estimate that I have done 90% of the research for this project from data obtained via on-line resources. Using the Internet, Lexis / Nexis databases and telephone interviews I was able to obtain the bulk of my data (please see Bibliography for list of on-line resources). I also have been doing various forms of telecommuting for the past four years and have found that I have been able to conduct real estate transactions with a great deal of efficiency without being tied to a specific location.

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[1] Mitchell, W, City of Bits, Pg. 9

This study begins with the examination of telecommuting, and the reasons for the underestimation of its growth and potential. It continues by reviewing recent research and evaluating their findings. Eventually leading to the question of will telecommuting become a work-style used by enough of the world's population to cause changes in the amount of real estate space consumed and /or developed.

Since the quantification of the amount of telecommuting being pursued is difficult to obtain, this study examines several sources of data in order to help infer both past and future telecommuting use.

Telecommuting Defined

Telecommuting is one of the "buzz words" of the 80's and 90's. It is the new work-style that reportedly would allow expanded freedom, happiness and flexibility for the U.S. worker. Even though this term has been used for quite some time, telecommuting has come to be defined in an assortment of ways. This "loose" definition makes measuring the total amount of telecommuters difficult, thus adding to the confusion. These varied perceptions help to foster a misunderstanding that hinders an individuals consideration of the possibilities and advantages being offered. As example, I have included several common interpretations of the term as reference.

1. <u>Computer / Internet centered work:</u> The 1995 American Heritage Dictionary simply as: "**tel•e•com•mut•ing** (tĕl′≤-kə-myo͞o′t≤ng) *n. Computer Science* 1. The practice of working at home by using a modem and a computer terminal connected with one's business office[2]."

Although the Internet and other computer related technologies have made the prospect from working from a remote location a more viable one, a computer is not necessary for one to telecommute. Admittedly many of the pioneers of telecommuting were "high-tech" companies and consulting firms that were able to capitalize on their knowledge and installed infrastructure of technology to help compensate for the ramifications of being apart from a central work group. It is presently more commonly recognized that "non-computer" related work (i.e., reading, talking on the telephone, using fax machines, etc.) also qualifies as telecommuting.

2. <u>Part time or full-time:</u> Exclusivity of working at a home or a satellite location is not an important distinction of a telecommuter. The budgeted time at any location varies depending on the goals of the funding entity, employer and / or participant. In fact some of the charters of telecommuting proponents restrict a participant from working from home

[2] 1995 American Heritage Dictionary v. 4.0

full time.[3] This helped to foster workers hesitations for reasons of isolation from the work group.

3. Lessened travel requirements: The terms telecommuting and teleworking (the use of telecommunication technology to conduct work) are also often used interchangeably. Reduced travel time for a worker is often one of the goals of the implementation of a telecommuting policy. Paradoxically, increased communication capacity does not necessarily yield less travel[4].

Just as the development of the U.S.'s transportation infrastructure (first with railroads, then with highways) allowed manufacturing firms to economize by locating their space intensive (and therefore costly) storage operations outside of the metropolitan CBDs'.[5] The creation of increased communication technologies channels has fostered the creation of strategic relationships that would have been logistically / economically impossible in not to the distant past. Some of these relationships have been shown to increase the distance traveled by the worker in the aggregate.

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[3] Washington State Energy Office. *Telecommuting: An Alternate Route to Work*. Olympia, Washington, 1990

[4] P. L. Mokhtarian. *Transportation Research*, A Typology of Relationships between Telecommunications and Transportation. *A*, Pg. 231-242, Vol. 24A, Number 3, 1990.

[5] DiPasquale, D., Wheaton, W., "Urban Economics and Real Estate Markets", Pg. 100 - 103, Prentice Hall 1996

Reflections and Evaluations of Telecommuting Development in the U.S.

The varied definition of telecommuting has hindered the ability of researchers to estimate the true extent of telecommuting. General consensus seems to be that there is currently little comprehensive data that measures the extent that telecommuting is being used in the U.S.[6]

This has lead to estimates of telecommuting to vary depending on the "expert" or source asked. As example consider these disparate quotes from recent journals:

1. Futurists have wrongly predicted for decades that telecommuting would be the death of cities. A massive effort by the California Department of Transportation get employees to use satellite offices, for example, was largely a failure, according to a recent study by the Ontario-based Institute for Telework, part of the Center for the New West.[7]

2. Indeed, in spite of well-publicized failures, the practice of telecommuting continues to grow steadily. Last year, 8 million Americans worked one or more days out of their homes, double the level of 1990. Of those, 1.6 million used e-mail, twice the level in 1994, according to Find/SVP a research company.[8] According to an article in the July issue of Risk Management magazine, IBM saved $1.4 billion in real estate costs by closing underutilized office space and establishing a telecommuting program.[9]

The previous examples are indicative of the varied and wide ranging opinions which currently abound. Most likely the *true* state of telecommuting lies somewhere between

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[6] Joroff, M., Interview September 14, 1996

[7] Helm, L., The Cutting Edge; The Fading Metropolis; Can Big Cities Survive The Onslaught Of Digital Commerce? LA Times, June 3, 1996

[8] Helm, L., The Cutting Edge; The Fading Metropolis; Can Big Cities Survive The Onslaught Of Digital Commerce? LA Times, June 3, 1996

[9] Managing Risk, Beyond the Trend, August 19, 1996

these two sample opinions. Nevertheless while the *quantity* of telecommuters may be uncertain, the amount of interest in this subject by firms in the real estate industry is not. Current research realizes this problem of standardizing the definition(s) of the various Internet terms and is currently attempting to enact methodologies with which to increase the accuracy and consistency of future censuses.[10]

The following is a selection of recent research reporting the changes occurring to the real estate landscape in response to the changes occurring with telecommunications. While the opinions listed are not always consistent in their views, they provide interesting background with which to evaluate my final hypothesis. Also important to note is the diverse nature of the sources I have chosen to include. In order to account for the wide ranging effects of telecommuting, I believe that one needs to examine research from many sources in order to compile an accurate profile. Herein lies the flaw of many studies, most of which use a somewhat narrow view in order to reach their conclusions. I feel that each method while correct when taken alone fails to accurately portray the scope of the telecommuting phenomenon. Bearing this in mind, the following is a summary and critique of several studies on telecommuting which are representative of the varied views which exist.

Internet User Surveys

Extrapolation of the number of telecommuters from the number (or growth) of Internet users although intuitive, is not necessarily accurate. For example, it is difficult to distinguish if the people surveyed are using the Internet for recreation, for telecommuting or both and with what proportions. Limited sample sizes, inconsistent definitions and sometimes questionable methodologies combine and compound potential inaccuracies. Despite these flaws I believe that it is nevertheless important to consider these studies since they help to build an inference to the acceptance and prevalence of networking technologies. The examination of this research in the aggregate is especially useful even if absolute figures cannot be determined they cumulatively help to estimate scope and proportion. The rationale being that as increasing numbers of the U.S. population better understand the nature of the benefits (and disadvantages) of networking technologies it

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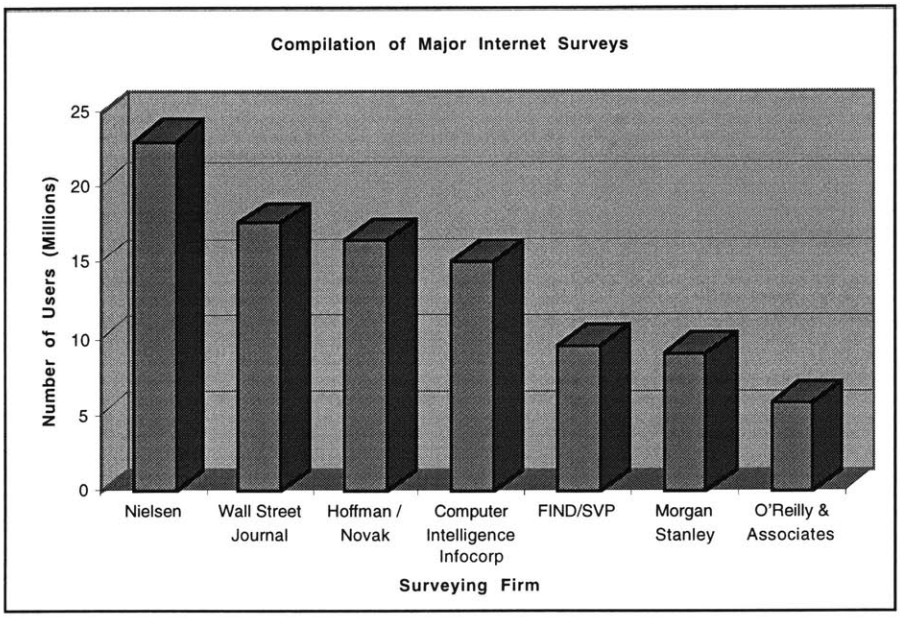
[10] Pratt, J., Counting the New Mobile Workforce, Bureau of Transportation Statistics, U.S. Department of Transportation, 1996

becomes indicative of the *likelihood* of use by an individual.

As example of the difficulty of Internet research, a recent journal[11] likened the process to "trying to count the funny hats at a Shriners convention. You know the number is pretty big, but there's a good chance you'll count the same heads more than once. You'll probably miss a bunch too because you surely won't be able to look in all the corners." The following is a compilation of several recent surveys[12] attempting to count the number of Internet users.

Surveying Firm	Date of Survey	Est. Number of Internet Users (M=Millions)
Nielsen	October 1996	23.0 M
Wall Street Journal	March 1996	17.6 M
Hoffman / Novak	April 1996	16.4 M
Computer Intelligence Infocorp	May 1996	15.0 M
FIND/SVP	January 1996	9.5 M
Morgan Stanley	February 1996	9.0 M
O'Reilly & Associates	July 1995	5.8 M

[11] Bott, E, PC Computing, Internet Lies: Miscounts and Managed Morality, Pg. 190, October 1996
[12] CyberAtlas 1996



With ranges of 5.8 to 23 million users (approximately 2.3% - 9.2% of the U.S. population) the number of Internet users is definitely not certain. But given the varying survey methods and disparate definitions used to define Internet users, diverse results are to be expected. However even when one uses the most conservative figure (5.8M) this represents a significant and most likely growing segment of the population.

FIND / SVP and LINK Resources[13]

Two of the most published Internet research organizations are FIND / SVP and LINK Resources (hereafter referred to as FSL). Recently FSL published abstracts from their current Internet survey which is considered by many to be the most comprehensive. FSL's data was collected via telephone interviews during their 1995 American Information User Survey of 1,200 randomly selected U.S. households. The margin of error with the survey is +/- 3% at the 95% confidence level. Results were then extrapolated from the households sampled towards the general U.S. population. The following is a summary of their findings.

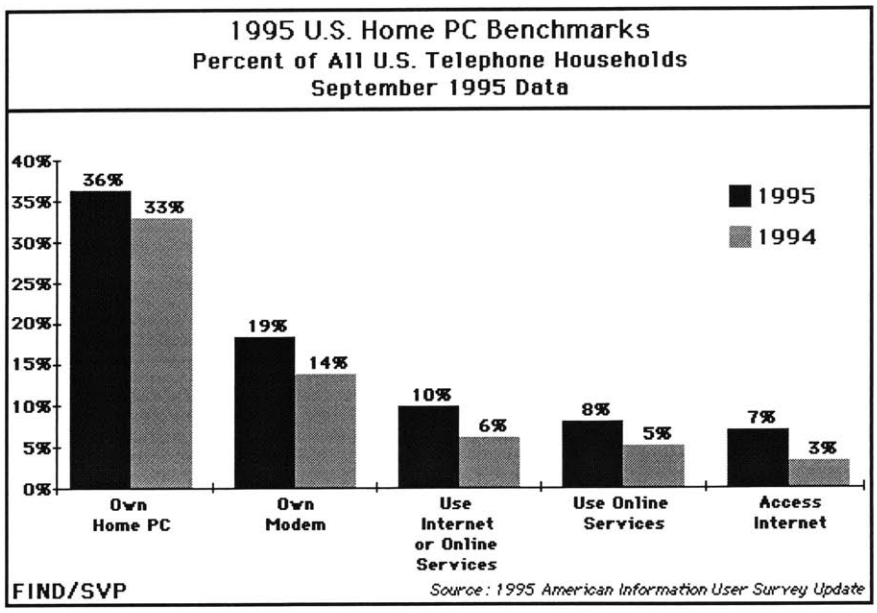
FSL reported that the telecommuting trend appears to have gone through major redefinition

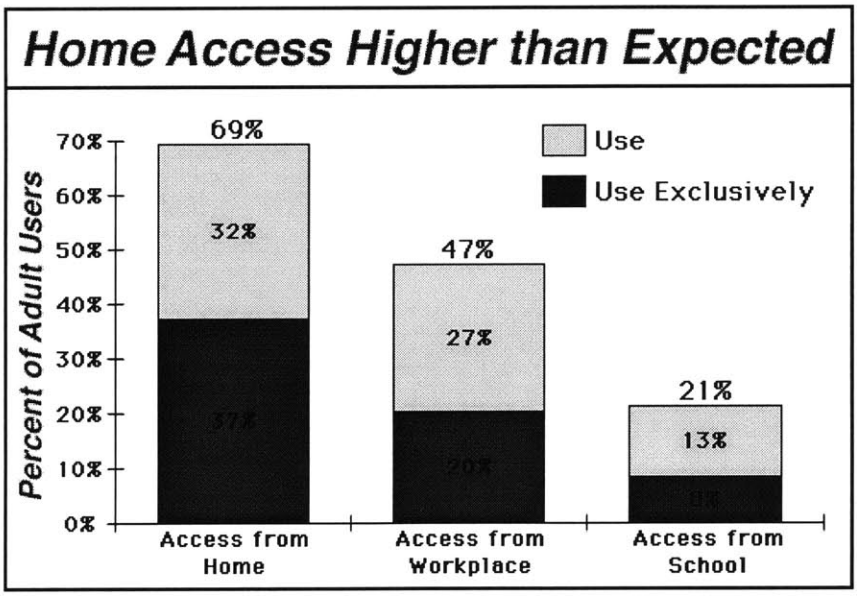
[13] Miller, T., Find / SVP and Link Resources 1995 Telecommuting Fact Sheet,, March 1996

during the past 12 months, with significant growth occurring among business professionals, computer users and contract workers, and significant reductions in participation occurring among various blue collar and other occupations not strongly associated with performance of organizational information work. This finding is not surprising since on-line penetration has been found to be strongly correlated with household income.[14] Given that technology has only become cheaper and the one year period is not sufficient time for significant obsolescence to occur. Causes me to question why the number of in the "blue collar, et al group" experienced a decrease in participants.

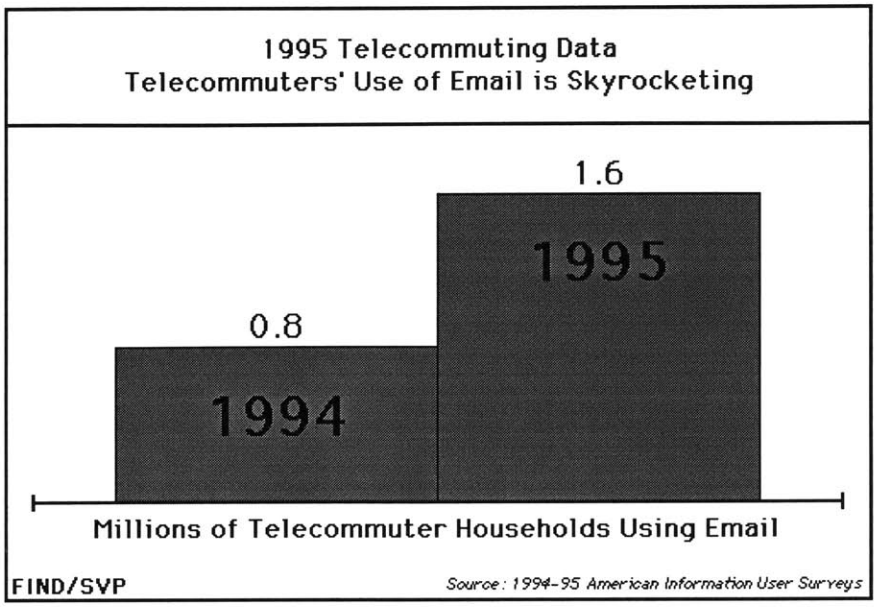
FSL also reported that the total number of telecommuters in the U.S., defined as employees or contractors who work at home one or more days per month during normal business hours, was found to be 8.1 million in September 1995, down from 9.1 million the prior year. Even as the number of daytime telecommuters declined, use of after hours work at home was found to have increased, along with home-based self-employment. FSL suggests that there is a sea-change occurring in organizational-employee relationships and that corporate down-sizing and out-sourcing has made it less attractive for full-time employees to request home telecommuting arrangements out of fear of losing in-office visibility. At the same time employers have increased managerial and professional workloads, thereby driving up after hours work activity. Meanwhile, the survey also indicates that as many as 500,000 more contract telecommuters are in place this year compared to last, totaling 3.1 million contract telecommuters. FSL implies that companies may be trying to off-load overhead by shifting to contingent workers with low or no associated benefits costs and with no bricks and mortar costs.

[14] National Telecommunications and Information Administration

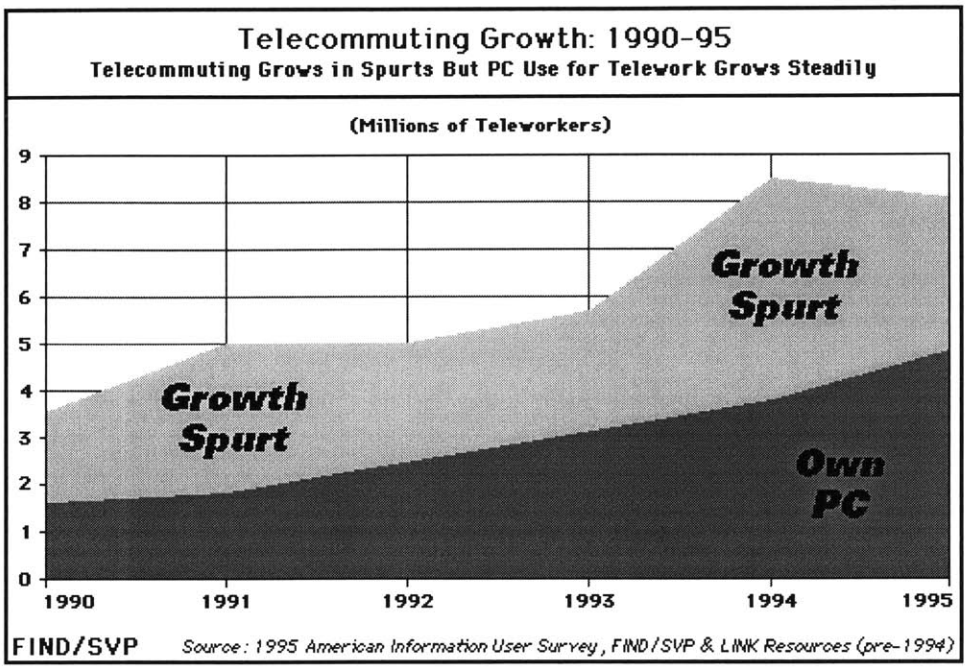




FSL also reported that PC use among telecommuters rose dramatically, with 59% of telecommuter households reporting home PC usage (vs. less than 50% last year). Use of email is especially hot, consistent with strong growth of the Internet and commercial on-line services. As such, the total number of telecommuter households using email doubled in the past 12 months, from some 800,000 in 1994 to approximately 1.6 million in 1995.



Speculating further about the overall trend growth pattern, FSL believes corporate acceptance of computer networking, coupled with extraordinary growth of interest in using the Internet is establishing a wider pattern "telework" adoption, of which telecommuting can be seen as a specialized application. The chart of historical telecommuting growth shows a prior growth spurt in 1991 where the total number of telecommuters outpaced technology-using telecommuters, only to flatten in the following year as technology usage advanced (see chart). This caterpillar-like growth, rather than straight-line growth, suggests that periods of interest and experimentation are occurring followed by a kind of consolidation as practitioners define what telework is useful for. At the core, FSL suggests that telework is clearly a very flexible work style that can be used ad hoc as well as in more formalized relationships which can also be based on contract as well as full-time employee relationships. FSL look for renewed overall growth in the trend as electronic networking expands, and FSL expects the total number of telecommuters as traditionally defined in our surveys to resume its familiar upward trajectory--with ever greater usage among knowledge worker occupations, in particular.



Despite being the most current figures available, problems with relatively small sample size (1,200 in FIND/SVP's case) and the lack of a consistent definition of "Internet users" is difficult to ignore. Therefore the resulting wide ranging estimates, although expected, make evaluation of the subsequent results problematic. Also given the tendency for firm agglomeration[15] I question if these figures result in an underestimate when attributed to the nation as a whole.

Corporate Real Estate 2000

Well known for researching the changing real estate workplace, co-author of the Reinventing the Workplace series, Michael Joroff has studied the changes occurring in various firms for quite some time. Especially notable is that they are among a handful of researchers that have explored technology changes specifically as they relate to real estate firms and owners in addition to their more general studies.

Joroff[16] stated recently that "the issues of measuring the effect (telecommuting has on) the gross real estate market are unimportant." That quantifying the "market supply" effect

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[15] DiPasquale, D., and Wheaton, W., "Urban Economics and Real Estate Markets", Pg. 170, Prentice Hall 1996

should be secondary to the apperception of changes occurring in "tenant demands". Relevant factors to consider are the "cost savings to companies, the improved alignment of the workplace and worker, and the changing mentality about the concept of "spaces."

"Two platforms are melding", and a shift is occurring from focus upon the "physical to the electronic." Instead of people meeting and working around a "big table, they are shifting towards meeting via big networks." Changes in technology allow increasingly larger and more distant groups to work together, and thus create a workgroup comprised of a "multiplicity of layers." These changes have importance for the real estate developer and manager who want to continue to meet their client (the tenant's) evolving needs.

"Developers will have to guess the future needs of their tenants." Joroff states that three major shifts in firms are occurring, 1. The development of an increasingly global economy 2. The emergence of new ways of working and 3. The ways new technologies are enabling these new work-styles to succeed. He continues, "The successful real estate professional will be one able to perceive and understand how to best meet the ramifications of these changes."

Joroff concluded with, "The game is wide open. Things are evolving, the workplace is going through a metamorphosis and although the future terrain is unclear, it is certain that there will be tremendous ramifications."

Joroff does not attempt to quantify the amount of change taking place and argues that this is not relevant. I would tend to disagree on the basis that without measures with which to gauge the extent or scope of the various office strategies one cannot prepare an adequate response strategy. However this is not to demean the importance of the case study method and experience embodied within Joroff's views, but rather to emphasize the importance of the integration of quantitative as well as qualitative data.

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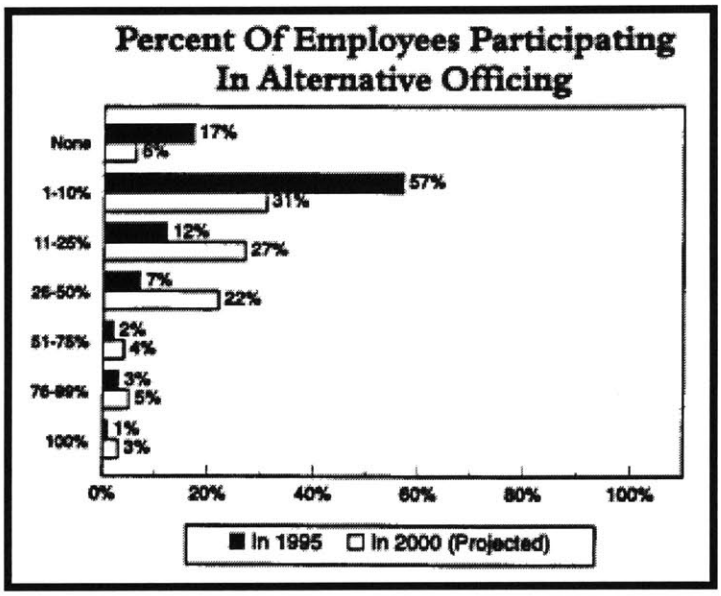
[16] Joroff, M., Interview September 14, 1996

Haworth, Inc. / International Facility Managers Association (IFMA) Foundation[17]

During the first quarter of 1995, IFMA in conjunction with the Gelb Consulting Group conducted a random survey of 4,004 IFMA members polling their firm's experience and knowledge of alternative officing methods. This survey has special relevance because of its target group and current data. IFMA members consist of the facility managers of companies, the majority of which fall within the Finance, Insurance and Real Estate (FIRE) or Business and Professional (BP) Services sectors which consume approximately 75% office space in the U.S.[18]. With a response rate of 20% (796 of 4,004) IFMA made the following observations regarding telecommuting .



Most facility managers surveyed expected the use of alternative officing to increase by the year 2000. Eight in ten (83%) facility managers reported that some number of employees would participate in alternative officing by the year 2000. Further, while one-quarter of the facility managers reported that at least ten percent of their employees would be involved in alternative officing in 1995, 60% expect that level of participation by the year 2000. I believe it is uncertain if this should be perceived as pure speculation on the manager's part, or indicative of insight afforded to these who would be in the best position to know.

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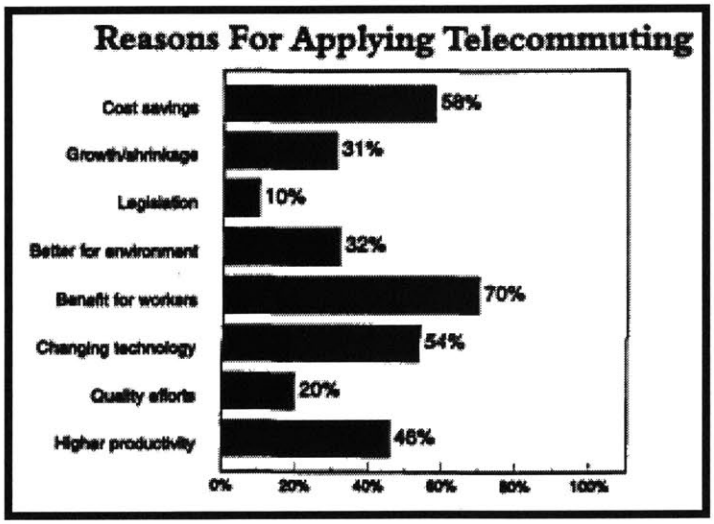
[17] IFMA Foundation / Haworth Inc., Alternative Officing Research and Workplace Strategies, 1995
[18] DiPasquale and Wheaton, W., 1996

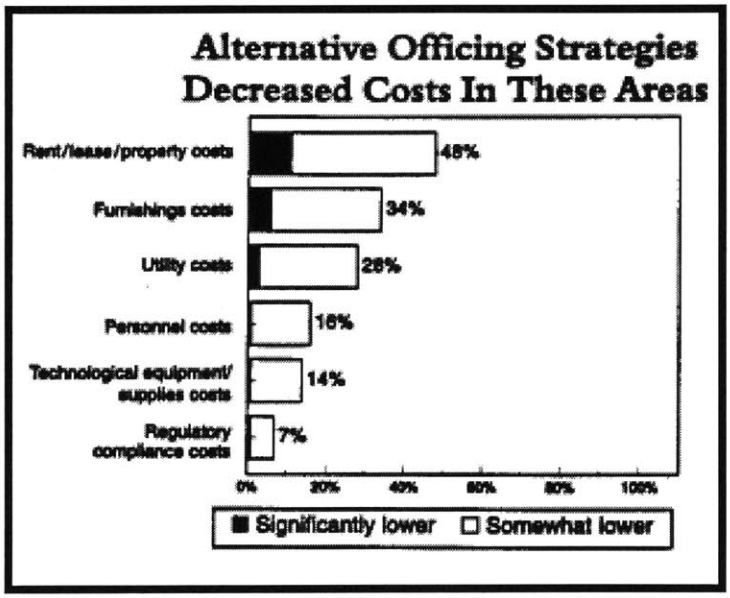
IFMA also found that facility managers in the manufacturing and service sectors were much more likely than those in government / education sectors to report use of alternative officing strategies. I found this to be in conflict with FSL's findings that blue collar telecommuting had decreased. Although this may be due to the lack of IFMA to distinguish between blue collar and white collar workers within industries.

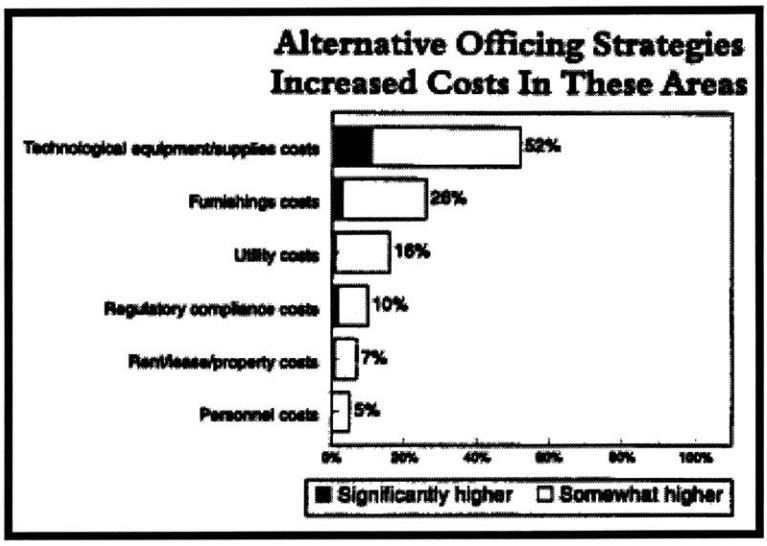
IFMA found medium-sized organizations (1,000 to 2,499 employees) were most likely to be involved currently in alternative officing while large organizations (2,500 or more employees) were least likely. I would speculate that this is due to the stronger corporate cultures present in larger organizations which tend to offer greater resistance to alternative officing strategies. Resistance by upper management was also listed as the most common barrier to telecommuting implementation (46%).

Almost half of the facility managers reported decreased rent, lease and property costs as a result of implementing an alternative officing strategy. The reductions were reported most often by facility managers in the service industry and at larger facilities. This can be attributed to economies of scale issues which tend to be more applicable to larger companies.

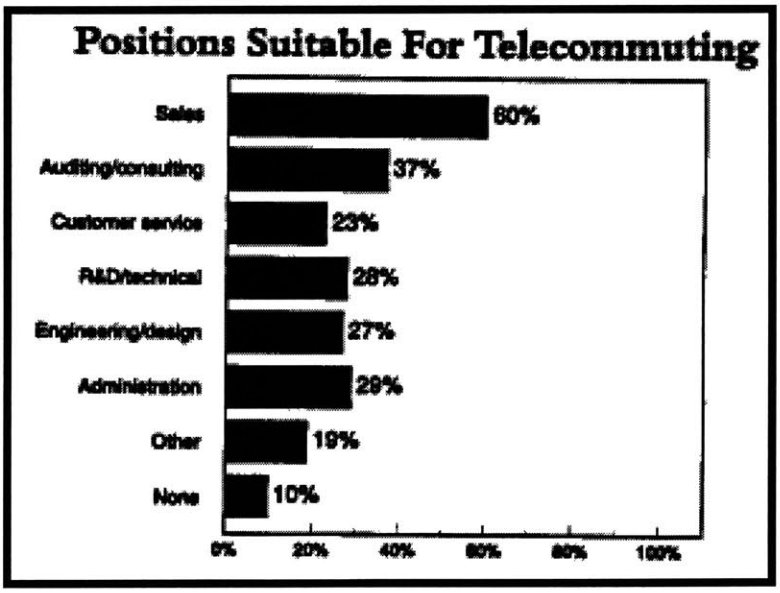
One third reported a reduction in furnishing costs and 28% experienced reduced utility costs. More than half of the facility managers experienced increased costs for technological equipment and supplies as a result of implementing alternative officing strategies. One-fourth reported an increase in furnishings costs. The areas of increasing and decreasing costs did not vary significantly by the size or industry classification of organizations. Respondents were more likely to report off-premise strategies such as telecommuting as better for the environment than other alternative officing strategies. The rationale being that the environment benefits from off-site strategies because travel to and from work is decreased. Reduced travel is a common misconception of telecommuting implementation, aggregate travel may in fact increase (see pg. 33).

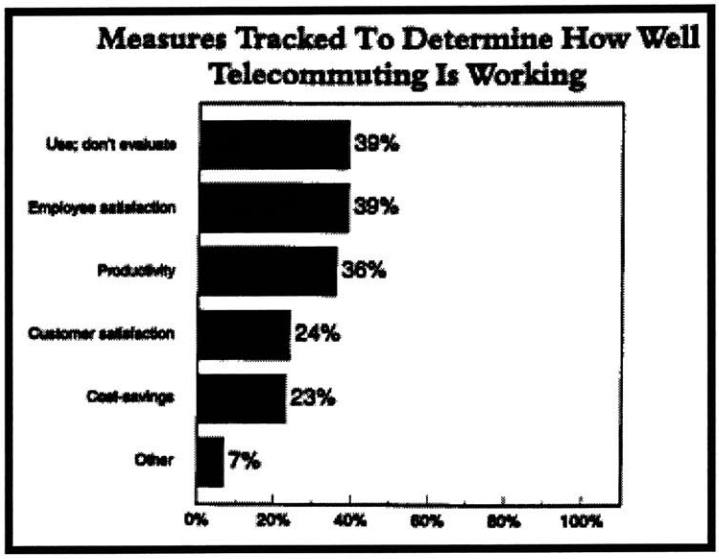

Reasons For Applying Telecommuting
Cost savings
58%
Growth/shrinkage
31%
Legislation
10%
Better for environment
32%
Benefit for workers
70%
Changing technology
54%
Quality efforts
20%
Higher productivity
46%
0%
20%
40%
60%
80%
100%


Alternative Officing Strategies
Decreased Costs In These Areas
Rent/lease/property costs
48%
Furnishings costs
34%
Utility costs
28%
Personnel costs
16%
Technological equipment/
supplies costs
14%
Regulatory
compliance costs
7%
0%
20%
40%
60%
80%
100%
Significantly lower
Somewhat lower



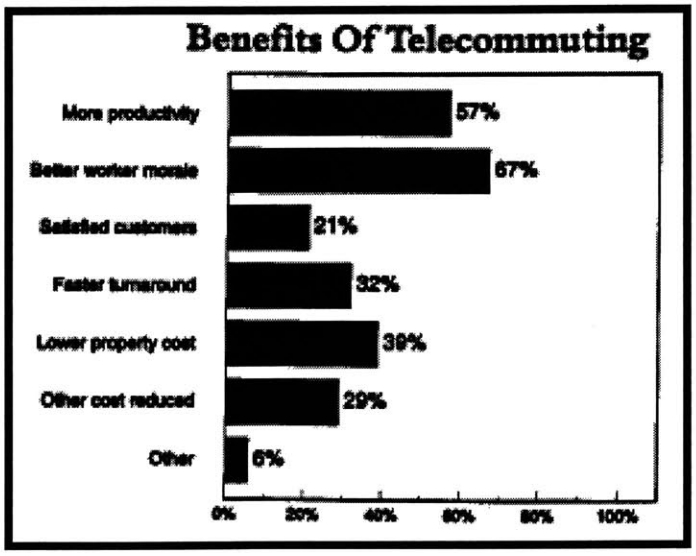
Telecommuting was the most commonly used (33%) off-site / off-premise strategy with sales being the position most commonly named as suitable for telecommuting (60%). Not surprising since many say that salespersons have been engaging in telecommuting for quite some time. Only one in ten did not consider telecommuting appropriate for any positions.

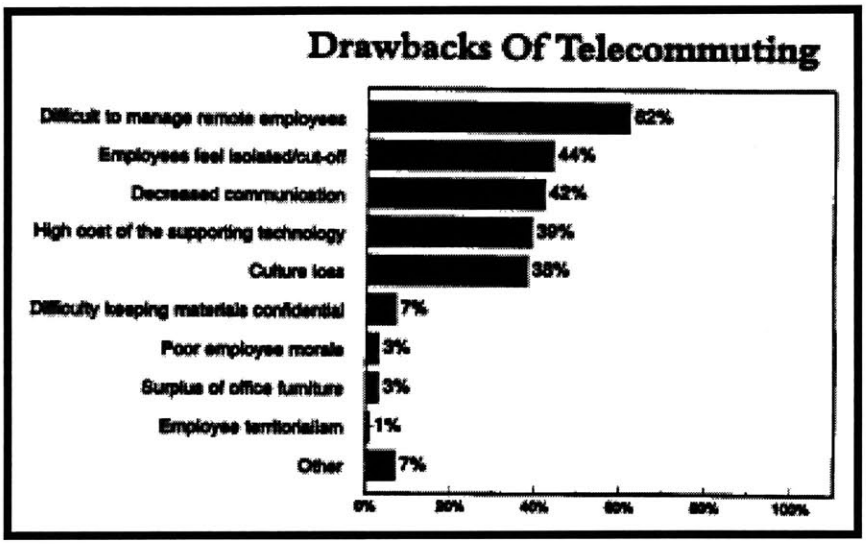


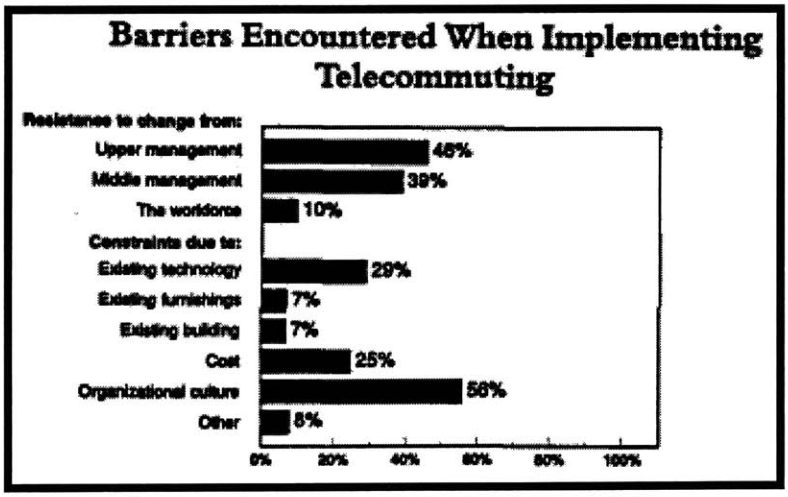


Among participants using telecommuting, six in ten (61%) stated that they tracked measures to evaluate effectiveness. Almost 40% of the facility managers measured employee satisfaction and productivity. Seven in ten (70%) facility managers investigated telecommuting due to perceived worker benefit. When asked why they investigated telecommuting, seven in ten (70%) facility managers named worker benefits and six in ten (58%) named the potential cost savings. Changing technology and potential increased productivity were other common motivations for looking into this alternative officing strategy.

Telecommuting (67%) and virtual officing (57%) appeared to have the greatest impact on increasing employee morale. Productivity increases were listed as a benefit for all off-site / off-premise practices. Difficulty in managing remote employees was the most frequently reported drawback to telecommuting. Other common problems were employees' feeling of isolation, decreased communication, the high cost of supporting technology, and a loss of culture. Organizational culture and resistance from upper and middle management were the barriers most commonly encountered in the implementation of telecommuting. Resistance from upper and middle management was stronger for telecommuting than for most other officing strategies.


Benefits Of Telecommuting
More productivity
57%
Better worker morale
67%
Satisfied customers
21%
Faster turnaround
32%
Lower property cost
39%
Other cost reduced
29%
Other
6%
0%
20%
40%
60%
80%
100%


Drawbacks Of Telecommuting
Difficult to manage remote employees
82%
Employees feel isolated/cut-off
44%
Decreased communication
42%
High cost of the supporting technology
39%
Culture loss
38%
Difficulty keeping materials confidential
7%
Poor employee morale
3%
Surplus of office furniture
3%
Employee territorialism
1%
Other
7%
0%
20%
40%
60%
80%
100%


Barriers Encountered When Implementing Telecommuting
Resistance to change from:
Upper management
46%
Middle management
39%
The workforce
10%
Constraints due to:
Existing technology
29%
Existing furnishings
7%
Existing building
7%
Cost
25%
Organizational culture
56%
Other
6%
0%
20%
40%
60%
80%
100%

The results of the IFMA's study are interesting and seem to confirm many of the common benefits associated with telecommuting such as reduced costs, increased employee satisfaction, increased productivity, etc. Since the survey was completed recently the timeliness of the results are especially applicable. Telecommuting's disadvantages and management's concerns of reduced control were also reiterated by the survey respondents. The biases and benefits inherent in asking a real estate specific group brings forth potential issues of how applicable the data is towards the general population of the U.S.. Since survey responses were voluntary (albeit they received a large number of responses (20%)) I question if the results may be biased due to a respondent's interest, knowledge and / or involvement in the subject of telecommuting. Overall though, because of their implementation of random mailings and high response rate, IFMA's methodology appears sound and the insight derived from polling only real estate professionals (when realized as such) outweighs the issues of applicability.

Torto Wheaton[19]

The research done by Torto and Wheaton have several notable qualities (in addition to each of the Principal's respective expertise in conducting real estate economic analysis). Because their firm is a subsidy of CB Commercial, they have access to one of the most comprehensive data sets regarding U.S. commercial property in existence with which to base their opinions.

For the sake of brevity I have included excerpts culled from a 1996 National Real Estate Investor (NRI) article on Technology's effect on real estate demand, where Raymond Torto, principal of Torto Wheaton Research in Boston was reported as saying, "Bridging the gap between the "virtual" world and the real world is one of the most difficult tasks facing today's real estate manager.". With the main arguments of telecommuting proponents being:

1. There will be fewer office-related jobs in the future.

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[19] Johnson, B., Heitman Symposium serves up new corporate real estate strategies., National Real Estate Investor, May 1996

2. We will need less space per office worker.

3. Inventory management practices will eliminate the need for warehouse space.

"All of these issues depend on your perspective," said Torto. He continued to state, "Tackling the arguments one by one, all evidence points to a continued growth rate in total office employment of about 1%.". This relationship is based on the correlation that historically has existed between office employment (defined by FIRE and BP workers) and net space absorption (i.e. positive net absorption represents increase in space demanded)[20].

"By implication, there's growing demand for space going forward, said Torto. "So what's going on? I read about downsizing, but I wonder if what's really happening is there is an outsourcing of jobs to business services that are taking over those functions that are not corporate jobs. So corporate jobs are leaving, at least for the Fortune 500, but they're not vanishing from the economy. There's a vertical disintegration of jobs as they are outsourced." This concurs with the increase in sole proprietorships being listed with the IRS,[21] but assumes that demand elasticity for space remains constant which is somewhat inconsistent with the IFMA's survey which lists cost savings as impetus for enacting a telecommuting a strategy.

As for the argument that office workers will require less space per person, Torto's research indicates that the long-term trend is for increasing occupied space per employee, not decreasing. Torto reports that, some companies are even expanding their space requirements. "Because space today is relatively cheap compared to the recent past, what economists would call the 'price effect' is dominating all the technology issues." Here I believe that Torto is referring to the "significant and negative" relationship between rent / SF and occupied stock per worker.[22] This assumes that the rental elasticity of space demand is constant over time within markets, an assumption that I do not believe is

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[20] DiPasquale, D., Wheaton, W., "Urban Economics and Real Estate Markets", Pg. 295-296, Prentice Hall 1996

[21] See Pg. 33, Internal Revenue Service

[22] DiPasquale, D., Wheaton, W., "Urban Economics and Real Estate Markets", Pg. 296-297, Prentice Hall 1996

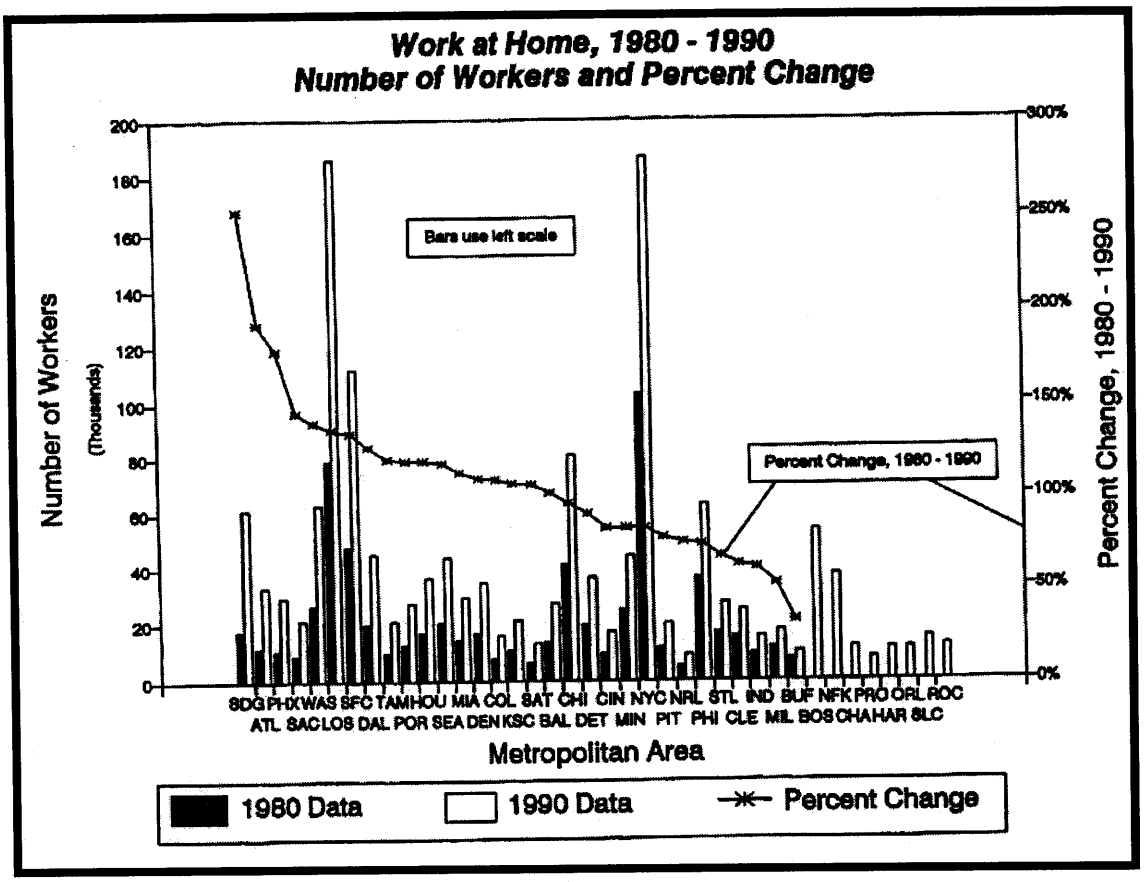
derived from available data.[23].

Torto Wheaton's affiliation with CB Commercial and access to its large commercial real estate database is the strength of this research. Given the lack of data to quantify the number of telecommuters and the newness of many of the advances in networking technologies constructing a correlation between examination of historical figures of occupancy expectedly yield little results. As mentioned previously, although examination of historical data will tend to yield a quantifiable output, it is difficult to predict current or future trend. I especially find the assumption that a firm's demand elasticity to remain constant over time to be unintuitive since historical tendencies may not be relevant given the rash of corporate downsizing and desire to decrease costs.

United States Department of Transportation (USDOT) 1993

A 1993 DOT report mentioned the apparent effect of telecommuting on transportation patterns in the U.S.. Using data collected during the 1990 U.S. Census this study used the broadest and largest sample of those I examined. The following are relevant selections from that report.

[23] DiPasquale, D., Wheaton, W., "Urban Economics and Real Estate Markets", Pg. 297, Prentice Hall 1996



Working at Home. The USDOT stated that working at home showed an overall loss of 27% during the thirty year period studied (1960-1990), suggesting declines in farming activity. This category, however, displayed a sharp turnaround during the 1980's in both absolute numbers and its market share. In 1980, 2.2 million people worked at home. In 1990, there were 3.4 million in this category. This change may indicate increases in telecommuting or other service oriented work at home employment.[24]

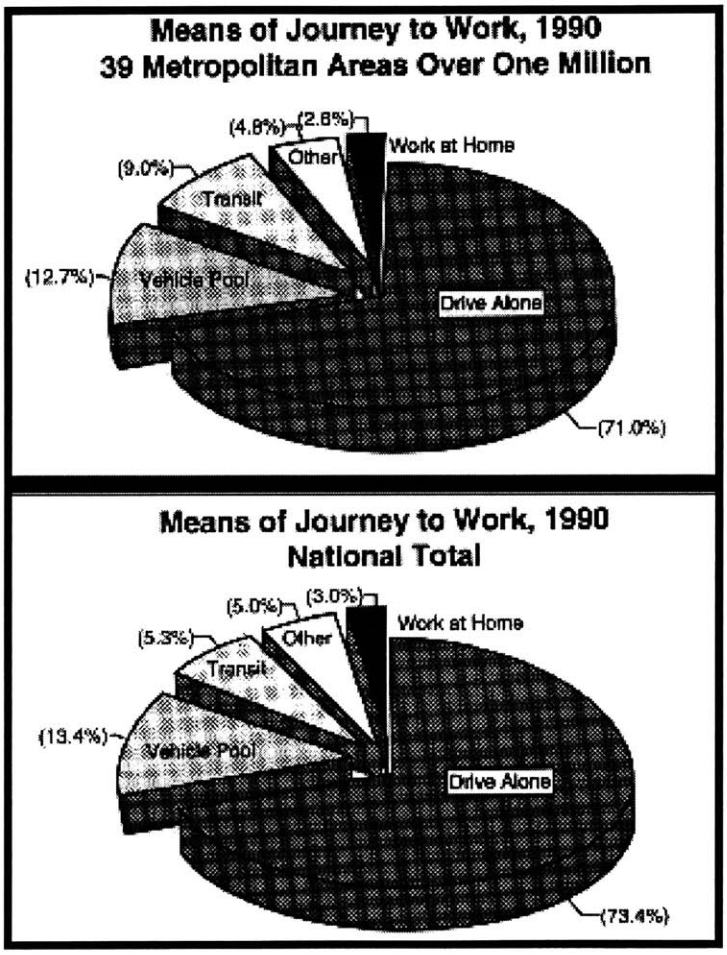
It was not mentioned how the USDOT determined and differentiated the cause of the original 27% drop in the 60's and subsequent increase to 3.4M in the 90's. Interesting to note is that the change during 1980-1990 represented increases of home workers ranging from 25% to 250% which cumulatively account for the 54.5 % increase overall.

Transportation Methods Used: Working at Home. In contrast to carpooling and public transit, the share of commuters who worked at home increased nationally from

[24] U.S. Department of Transportation , Journey-To-Work Trends in the United States and its Major Metropolitan Areas 1960-1990, DOT 1993

2.3% in 1980 to 3.0% in 1990. The pattern may reflect factors such as telecommuting and the rise of service oriented jobs, both of which are consistent with working at home.

Important to note here is that the national total of Work at Home is 3.0% while in largest cities it is 2.6%. Initially this seems unintuitive. Perhaps the percentage is smaller since the majority of the US population resides within these large MSAs the actual amount of telecommuters is larger. An alternate explanation would be that residents of the suburbs of these MSAs are excluded from the larger city figures.



Although comprehensive in its data set, the 1990 Census data is now six years old and most likely fails to be fully indicative of current trends. Although despite the age of its data there were still noticeable effects of telecommuting mentioned in the report. I believe that because of the age of the data this study most likely underestimates current telecommuting

levels.

Wired Magazine

Although not a formal study I have included an excerpt from Wired since it is a publication dedicated to chronicling the socio and technological trends of recent history. As such Wired Magazine with its avant-garde philosophy towards technology makes it an interesting source of information. Especially given that telecommuting acceptance requires as much of a revolution in traditional thinking as it does of technologies. Wired asked a panel that they identified as experts on the subject of telecommuting to estimate the likelihood of several telecommuting occurrences. I offer no critique of this article other than the opinions were not explored by Wired in detail. The following is a copy of the responses from their panel.

The Future of Telecommuting[25]

By the end of this year 9.2 million Americans will call themselves telecommuters - employees who use networked computers and cellular telephones to work outside the traditional office - according to a recent study by Link Resources Corp. Telecommuting can increase productivity and lower overhead costs, but running a "virtual office" raises important questions about decentralized management, worker responsibility, and loneliness for employees who have been cut loose from familiar work environments. Yet emerging technologies will make it easier to stay connected even as we move away from our burlap cubicles. Wired asked five experts to look at the future of telecommuting.

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[25] Pescovitz, D. The Future of Telecommuting, Reality Check, Wired Magazine, v. 3.10, 1995

	One-Fifth US Workers are Telecommuters	Universal Desktop Videoconferencing	Global Wireless Telephone Number	Fortune 500 "Virtual Corporation"
Franklin D. Becker	2005	2005	1998	never
Joe Carter	1999	1998	2010	1999
N. Fredric Crandall	2010	2005	1998	2000
Tom Newhouse	1998	2010	2000	unlikely
Van Romine	2000	1997	1998	1997
Bottom Line	**2003**	**2003**	**2001**	**1999**

Universal Desktop Videoconferencing

Even as remote work grows in popularity, desktop full-motion Videoconferencing remains beyond the reach of most telecommuters. Thin pipes and high cost are preventing the "virtual water cooler" from being bundled like CD-ROMs and modems, with business-use computers. "When the cost of desktop Videoconferencing falls below US$500 and when ordering ISDN is as easy as getting a burger at the local diner, things will start to shift," says Romine. But by then, Carter believes, "low bandwidth peer-to-peer networking, shared applications, and shared workspace tools that don't require video" may already fulfill most collaborative needs.

Global Wireless Telephone Number

As global business increases, our experts think global wireless communication will expand as well. While most business people don't need to talk on the phone while climbing the Himalayas, Newhouse thinks hand-held telephones that allow for global roaming will be useful in "the 24-hour world of finance and market analysis, where minutes mean millions. The same can be true for political organizations." But, according to Carter, international business politics may put personal satellite telephones on hold. "The complexities of crossing national borders and dealing with other countries' telecommunication monopolies are difficult to work out," he says.

Fortune 500 "Virtual Corporation

Most of our experts agree that the first Fortune 500 "virtual corporation" - a company without a traditional central headquarters - will still occupy some physical real estate. Becker predicts that large virtual corporations will maintain multi-use hubs combining meeting and communication centers, employee lounges, and classroom space for teaching new skills to a geographically dispersed work force. On the other hand, Newhouse believes "widely varied human personalities and job skill types" will keep at least half of a company's employees in a main office. "The headquarters," he says, "will be wherever the CEO is."

One-Fifth US Workers are Telecommuters

Our experts predict the number of telecommuters will triple in the next 15 years to 20 percent of the US work force, driven by stricter air-quality regulations, improved communications networks, and rising demand for adaptability in the business world. However, Crandall warns that the work-at-home route can lead to a "virtual dead end" of employee isolation and bureaucratic ineffectiveness. "The idea is to get people into the field so they can be more responsive to customer requirements," he says, "rather than trying to adapt to individual lifestyles." Becker adds that "a variety of easily accessed telework centers are likely to function at least as well or better than a home office."

Franklin D. Becker, Director, International Workplace Studies program, Cornell University; Partner, @Work Consulting Group

Joe Carter, Managing Director, Andersen Consulting Center for Strategic Technology

N. Fredric Crandall, Ph.D.; Founding partner, The Center for Workforce Effectiveness Inc.

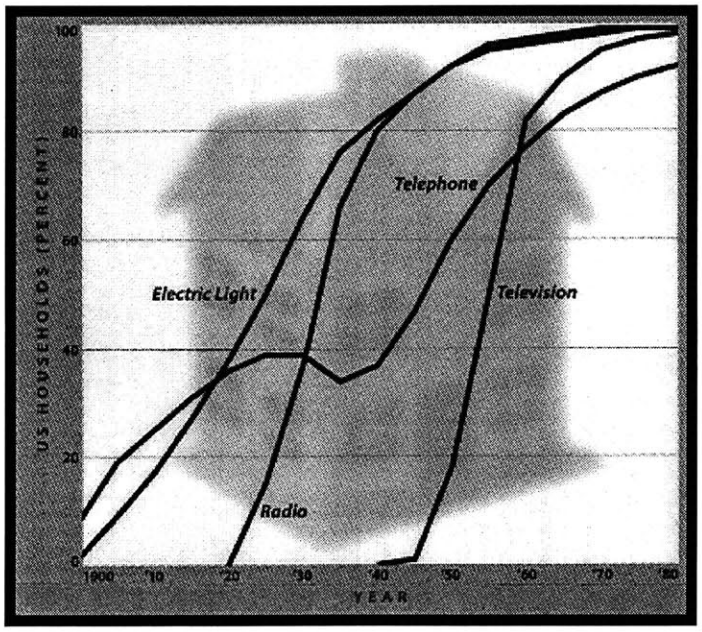
Tom Newhouse, Owner/Principal, Thomas J. Newhouse-Design, an industrial-design firm working primarily in the areas of office furniture and major appliances

Van Romine, Director, Institute for Telework

Hypothesis of Future Development of Telecommuting and its Effect on Real Estate Use

As my previous examples indicate, there certainly exists controversy regarding future development and ramifications of telecommuting. What is certain is there are fundamental changes occurring in the ways that Americans are communicating and working. To ignore these changes until quantifiable evidence of its effect on real estate use appears, would be a mistake. Due to the problems regarding the collection of data, results will most likely arrive too late for the people whom have the most to lose, namely the users, owners and investors of real estate. Although *backward* looking analysis is of course more *certain* than one based upon projection (as hindsight is 20 / 20). The results derived from such an analysis are far less useful for one to prepare for possible changes thus avoid financial loss. Towards this end, please consider the following:

Evolution and Acceptance of Technologies Historically[26]

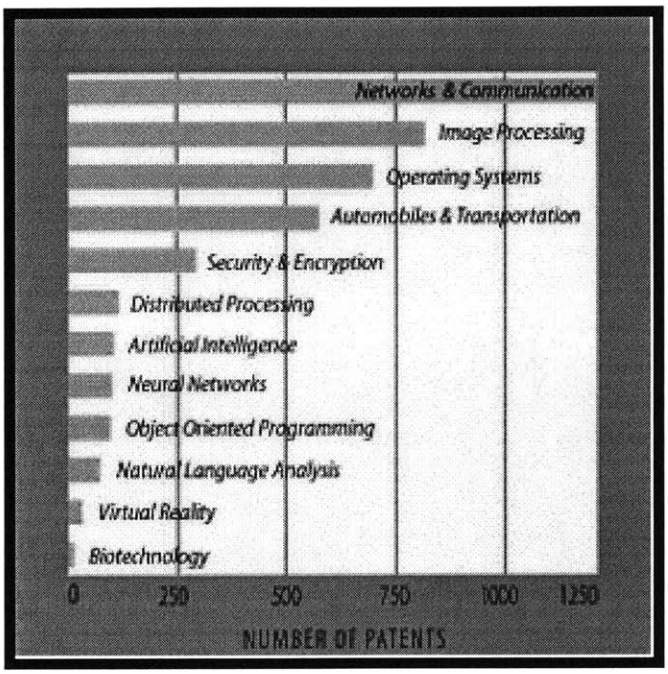


Historically, the adoption of new technologies has followed a similar S-shaped assimilation pattern. Interesting to note is that as the introduction date of the technology becomes more recent, the rate of assimilation by consumers also increases. For example

[26] US Bureau of the Census, Historical Statistics, and Statistical Abstract, 1990 (As published in Wired Magazine, April 1996)

electric light technology which was introduced in the early 1900's took approximately 50 years to reach 90% use, while television (circa 1940's) took only approximately 20 years to reach similar assimilation levels. This data infers that (1) the assimilation of recently introduced technologies (i.e. the Internet and other networking technologies) will tend to be faster than those technologies preceding it and (2) the full ramifications of the introduction of networking technologies has most likely not yet reached its pinnacle in the U.S.. If we apply the start date of the early 1980's[27] (the introduction date of the BITNET), we can estimate that mainstream use to occur by the early 2000' which is concurrent with the Wired survey average.

US Software Patents for 1995



Of the number of software patents submitted to the U.S. Patent office during 1995, the majority of the patents submitted dealt with issues of Networks and Communications.[28] This suggests that it will be this area that is attracting a great deal of interest as well as advancement in the near future. Of course this is the area that needs to undergo development in order for telecommuting to overcome the technological challenges mentioned by telecommuting opponents.

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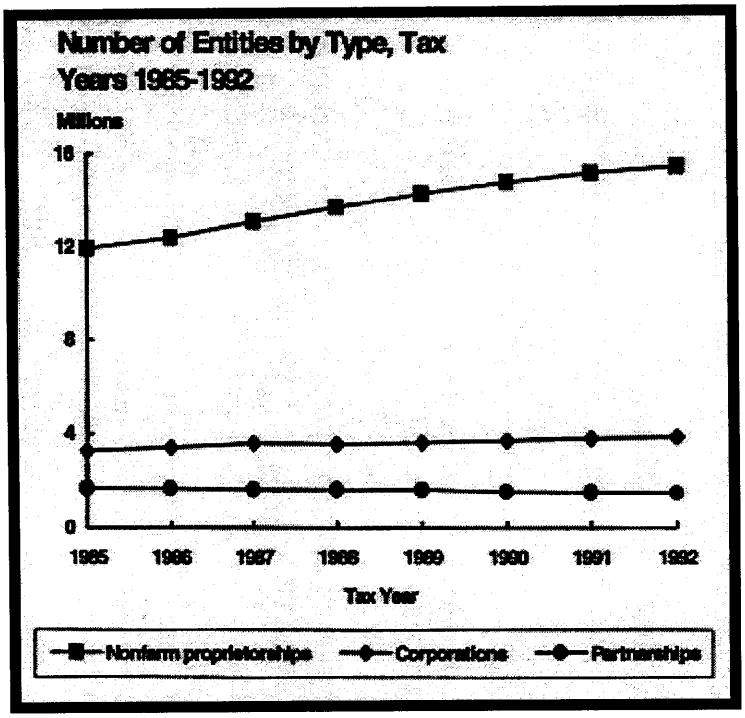
[27] Mitchell, W, City of Bits, Pg. 108

[28] Internet Patent News Service (as published in Wired Magazine, v. 4.05 Lapin T., Editor)

Internal Revenue Service

Non-farm proprietorships dominate the number of entities for the period of 1985 -1992 and the IRS estimates that their dominance in numbers will be increasing. Corporations were a distant second, followed by partnerships (whose numbers were reduced due to the loss of the passive loss limitations of 1986).[29] Supporting arguments of the workforce shift towards entrepreneurial ventures and the consolidation of more traditional corporations.



Business use of Home[30]

According to the IRS's Spring 1996 SOI Bulletin the amount of deductions claimed by non-farm sole proprietorships attributable to the "business use of home", increased 4.99% during the period of 1991 - 1993[31]. Perhaps indicating the increase of home workers.

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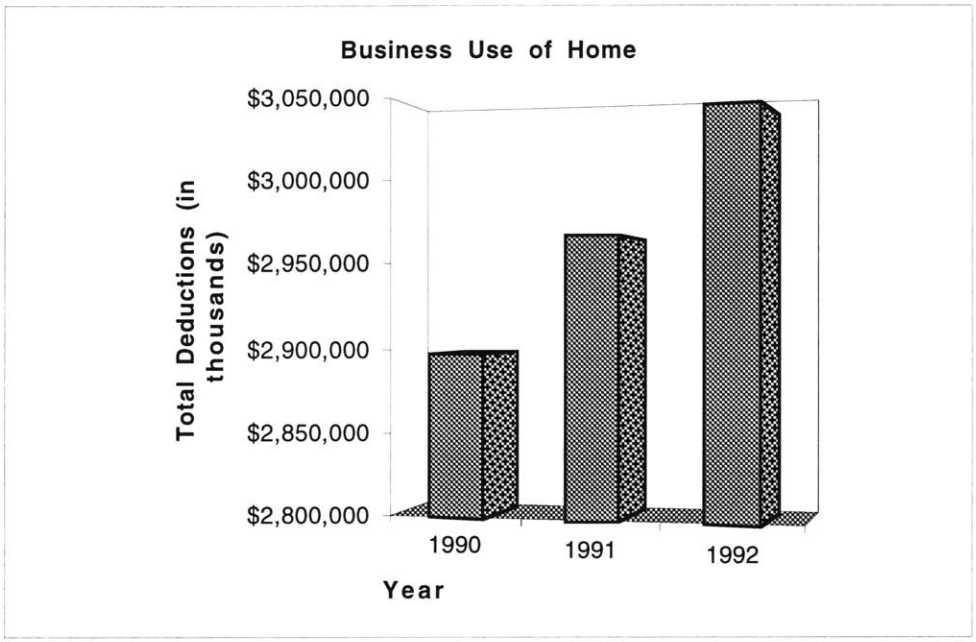
[29] Internal Revenue Service SOI Bulletin v. 15 Pg. 90, Spring 1996

[30] Internal Revenue Service SOI Bulletin v. 15 #4, Table 10, Non-farm Sole Proprietorship Returns, Spring 1996

[31] Assumes no sampling error, no significant tax law, nor tax form changes occurred during this period.

Item	1990	1991	1992	1993
Business Use of Home	n.a.	2,897,903	2,966,899	3,042,538
Annual % Change	n.a.	n.a.	2.38%	2.55%



Telecommuting and Residential Location in Monocentric Metropolitan Areas

An interesting hypothesis is posed by Lund and Mokhtarian[32]. In summary, the authors state that although recent empirical studies have shown that telecommuting has had relatively positive transportation impacts (i.e. non-work travel, vehicle distance traveled, peak-period trips, fuel consumption, and emissions had decreased) there remains some evidence that residential relocation effects of telecommuters has been previously underestimated. With possible ramifications being that the end result of telecommuting may be the nullification of any transportation savings incurred by telecommuting because of the tendency for participants to move farther from the CBD."

[32] Lund, J. and Mokhtarian, P., Telecommuting and Residential Location: Theory and implications for Commute Travel in the Monocentric Metropolis, Institute of Transportation Studies, University of California, Irvine, May 1994

From a continuation of the traditional Ricardian rent model[33] the authors state that "the magnitude of this effect will be greatest for intermediate levels of telecommuting in metropolitan areas characterized by relatively flat declines in land prices from the metropolitan center."[34] The resulting the net effect of telecommuting is to induce an outward location of residences from traditional centrally located workplaces.

This implies increased telecommuting for newer cities like those on the West Coast of the U.S. where residential property in close proximity to the established downtown core are not significantly more expensive than those in the suburbs. For a city such as Los Angeles where the rents at the downtown core are actually less than those of the suburbs will experience especially harsh ramification if this hypothesis holds true.

Regardless of the net effect of the transportation ramifications, the end result of increased residential dispersal and subsequent "urban-sprawl" is clear. Consumers of residential property may trade off initially reduced aggregate commuting costs (from telecommuting) for additional distance from the CBD in order to capitalize on the other factors used in property selection (such as preferences for density, scenic or recreational opportunities etc.). Therefore locations offering "higher quality of life" amenities will most benefit from increasing telecommunications technologies.[35] It will be interesting to determine what effects this trend toward decentralization will have on historically prominent industry agglomeration.[36]

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[33] Alonso 1964

[34] Lund, J. and Mokhtarian, P., Telecommuting and Residential Location: Theory and implications for Commute Travel in the Monocentric Metropolis, Pg. 8, Institute of Transportation Studies, University of California, Irvine, May 1994

[35] Lusht and Farber, Information Technology and Urban Structure, Real Estate Finance, Spring 1996

[36] DiPasquale, D., Wheaton, W., "Urban Economics and Real Estate Markets", Pg. 109-111, Prentice Hall 1996

Conclusion

As can be seen in my previous examples and critiques, I believe that it is apparent that there are many viewpoints with which one can use to base an opinion. The speed with which the advancements of technology are occurring has created a fervor adding fog to an already unclear landscape.

Currently there does not seem to be any evidence to suggest that *significant* reductions in the amount of office space consumed has occurred due to telecommuting. But since the solution largely depends on the gathering of precise data (other than anecdotal) counting the number of telecommuters, this is to be expected. Therefore to say that no effect is present would also be premature. Refinements of current survey methods and additional exploration must occur before a definite answer can be asserted.

Despite the existence of some confounding evidence, the most convincing arguments have led me to believe that future advancements in telecommunications technology can only erode the relationship between land value and the proximity to a CBD. Regardless of individual cases that may point to the contrary, I believe the evidence supports the aggregate effect will be one of continued decentralization of cities.

Changes in labor's preferences for additional flexibility and increased quality of life will help to spur on continued development of telecommuting use. While *full time* telecommuting will most likely be the least common of the telecommuting derivatives used[37], the advantages and ramifications of the implementation of even a part time strategy will be sufficient to be felt in real estate markets. Office properties (as well as their residential counterparts) that are able to offer the best combinations of access to information infrastructure as well as provide quality of life improvements for its occupants will fare best in tomorrow's market.

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[37] Handy, S. and Mokhtarian, P., Technical Memo 1: Current Levels of Telecommuting in California. Institute of Transportation Studies, University of California, Davis, prepared for the California Energy Commission, August 1993

As was proposed in the previous section, the markets which are most susceptible to telecommuting effects will have the following characteristics:

1. Labor Mix: Large concentrations of labor ideally identified as more suited for telecommuting (such as sales, consulting, information systems and certain service professions).

2. Technical Infrastructure : Areas with industries / organizations which currently use and are able to best provide the hardware infrastructure and knowledge necessary to support telecommuting (Universities, computer and communications related businesses, etc.).

3. City Age: Recently developed cities, especially those without fully developed urban cores will be the especially susceptible to increasing suburbanization.

But now is also a time of renaissance which I am convinced we have seen only the beginnings of. It is now commonplace to see business cards or advertisements include an email address or URL to a company web site side by side with the more traditional address and phone number. More interesting than the statistics quoting the number of subscribers of on-line services or the number of internet users, is the integration that this is occurring with areas historically disparate. Consider the amount of Internet specific television programs, publications and the recent occurrence of cross-marketed telecommunications services (companies that provide Internet access together with telephone long distance, cellular, paging etc.). These imply the telecommunications revolution is moving into areas previously overlooked and are indictors of the mainstream type of acceptance that is now occurring.

This is still a time of experimentation. Not unlike the early days of television when households first crowded around the set to see what "Uncle Milty" had in store for them. This is also a time when everything is still new, unscripted and live. Although the full effects of what will occur during this revolution will be only be accurately chronicled by historians, it is certain that Pandora has been let out of her box, and she isn't going back.

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On-line Resources

Economic

URL:
http://www.bea.doc.gov/bea/beadata.html
Comment: BEA Data and Methodology
Description: Bureau of Economic Accounts

URL:
http://www.clark.net/pub/lschank/web/ecostats.html
Comment: Business & Economics Numeric Data
Description: List of assorted sources of numeric economic and business data

URL: http://www.schwab.com/
Comment: Charles Schwab Online

URL:
http://www.inform.umd.edu:8080/EdRes/Topic/Economics/EconData/.www/contents.html
Comment: Contents of EconData
Description: Asortment of various popular economic data series

URL: http://www.olsen.ch/cgi-bin/exmenu
Comment: Currency Converter

URL: http://cta.ed.ornl.gov/data/data.htm
Comment: Data & Statistics

URL:
http://www.dbisna.com/dbis/dbishome.htm
Comment: Dun & Bradstreet Information Services

URL:
gopher://Niord.SHSU.edu:70/11gopher_root:[_DATA.ECONOMICS]
Comment: Economic Data Gopher
Description: Economic Data Gopher

URL:
http://bos.business.uab.edu/data/data.htm
Comment: Economic Time Series Page
Description: Various economic indicators in time series

URL:
http://www.bus.okstate.edu/eprice/econdept.htm
Comment: Economics Departments on the Internet

URL: http://www.ai.mit.edu/stocks.html
Comment: Experimental Stock Market Data

URL: http://www.stls.frb.org/fred/
Comment: FRED database
Description: Federal Reserve Bank Economic Data

URL: http://www.jpmorgan.com/
Comment: J.P. Morgan & Co. Incorporated

URL:
http://networth.galt.com/www/home/insider/insider.htm
Comment: NETworth: The Insider

URL: http://www.quote.com/
Comment: Quote.Com Stock Quotes, Business News, Financial Market Data

URL:
http://econwpa.wustl.edu/EconFAQ/EconFAQ.html
Comment: Resources for Economists on the Internet

URL:
http://econwpa.wustl.edu/EconFAQ/sc.html#SECTION00010000000000000000
Comment: SHORTCUT TO ALL RESOURCES
Description: Comprhensive list of many economic data sources

URL:
http://www.science.gmu.edu/csi779/drope/govstats.html
Comment: Statistical Agencies on the Internet

URL:
http://www.ai.mit.edu/stocks/graphs.html
Comment: Stock Market Charts from MIT

URL:
http://www.ustreas.gov/treasury/bureaus/irs/irs.html

Comment: The Department of the Treasury: Internal Revenue Service

URL: http://www.ustreas.gov/treasury/bureaus/irs/taxforms.html
Comment: The Department of the Treasury: IRS--Tax Forms and Instructions

URL: http://www.cob.ohio-state.edu/dept/fin/osudata.htm
Comment: The Financial Data Finder
Description: From Ohio State University

URL: http://www.census.gov/
Comment: U. S. Bureau of the Census Home Page

URL: http://www.mannlib.cornell.edu:80/usda/
Comment: USDA Economics and Statistics System

URL: http://weber.u.washington.edu/~bacs/research/oindex.html
Comment: UW Business School Research connection
Description: UW Business School Research connection

URL: http://www.helsinki.fi/WebEc/webecc8d.html
Comment: WebEc - Economics Data

General Reference

URL: gopher://tvnews.vanderbilt.edu/11/abstracts
Comment: abstracts-Vanderbilt

URL: http://att.net/dir800/
Comment: AT&T Internet Toll Free 800 Directory

URL: http://www.eb.com:180/
Comment: Britannica Online

URL: http://stats.bls.gov/
Comment: Bureau of Labor Statistics

URL: gopher://scilibx.ucsc.edu/11/The Library/Electronic Reference Books
Comment: Electronic Reference Books-UCSC

URL: http://www.fedworld.gov/
Comment: FedWorld Information Network Home Page

URL: http://www.fid-inv.com/fidbin/check_html
Comment: Fidelity Investments Home Page

URL: http://www.mit.edu:8001/geo
Comment: Geographic Nameserver-MIT

URL: gopher://sipb.mit.edu/1B%3aInternet%20whois%20servers
Comment: Gopher-whois-MIT

URL: http://www.mcp.com/
Comment: Information SuperLibrary
Description:

URL: http://lcweb.loc.gov/
Comment: Library of Congress World Wide Web Home Page

URL: http://www.cs.cmu.edu:8001/Web/references.html
Comment: On-line Reference Works-CMU

URL: http://www.neosoft.com/internet/paml/index.html
Comment: Publicly Accessible Mailing Lists

URL: http://alpha.acast.nova.edu/reference.html
Comment: Reference Shelf-Nova

URL: http://akebono.stanford.edu/yahoo/Reference/
Comment: Reference-stanford

URL: http://www.census.gov:80/stat_abstract/
Comment: Statistical Abstract-Gov
URL: http://thomas.loc.gov/
Comment: THOMAS: Legislative Information on the Internet

URL: http://www.refdesk.com/
Comment: Welcome - My Virtual Reference Desk
URL: http://www.gsa.gov/

Comment: Welcome to GSA

URL: http://www.pueblo.gsa.gov/
Comment: Welcome to the Consumer Information Center

Internet and MIS Research

URL: http://nii.nist.gov/tools/index.html
Comment: Analog form interface
Description: Analog form interface for the National Institute of Information Infrastructure

URL: http://cu-seeme.cornell.edu/~WCW/
Comment: Bill Woodland's CU-SeeMe Info Page
Description: Teleconferencing utility

URL:
http://www.cs.washington.edu/homes/lazowska/cra/networks.html
Comment: Computer Communication Networks

URL: http://cra.org/CRN/
Comment: Computing Research News Online

URL: http://cu-seeme.cornell.edu/
Comment: Cornell University's CU-SeeMe Page

URL: http://www.cyberatlas.com/
Comment: CyberAtlas -- Page One

URL: http://www.forrester.com/
Comment: Forrester Research

URL: http://www.frost.com/
Comment: Frost & Sullivan Home Page

URL:
http://www.cc.gatech.edu/gvu/user_surveys/User_Survey_Home.html
Comment: GVU Center's WWW User Survey Home Page

URL:
http://www.idcresearch.com/HNR/newsline.htm
Comment: Hot New Research

URL:
http://www.idcresearch.com/idcvol1/default.htm
Comment: IDC Publication Search

URL: http://www.idcresearch.com/
Comment: International Data Corporation

URL:
http://www.nw.com/zone/WWW/top.html
Comment: Internet Domain Survey

URL: http://www.webcom.com/walsh/
Comment: Internet Info
:
URL:
http://info.isoc.org:80/papers/index.html
Comment: Internet Society Papers and Presentations Index

URL:
http://product.info.apple.com/productinfo/tech/wp/mobilewp.html
Comment: Mobile Computing: An Apple Technology Perspective

URL:
http://www.nielsenmedia.com/news/hotech-summary.html
Comment: Nielsen Media Research - Interactive Services

URL:
http://www.spa.org/research/research.htm
Comment: SPA Press Releases: Research

URL:
http://www.webcom.com/walsh/stats.html
Comment: stats

URL:
http://etrg.findsvp.com/etrginfo/whoindex.html
Comment: The ETR Group: Who We Are

URL: http://www.hamquist.com/
Comment: The Hambrecht & Quist Home Page

URL: http://www.npd.com/
Comment: The NPD Group Home page

URL: http://www.webtrack.com/
Comment: WebTrack

Massachusetts Institute of Technology

URL: http://web.mit.edu/cre/www/
Comment: MIT Center for Real Estate

URL: http://nimrod.mit.edu/
Comment: MIT Libraries
Description: MIT Libraries

URL:
http://nimrod.mit.edu/depts/rotch/subjects/realestate/rehomepage.html
Comment: Rotch Library Guide to Real Estate Resources

URL: http://web.mit.edu/
Comment: The MIT Home Page

URL: http://web.mit.edu/sap/www/
Comment: School of Architecture and Planning

Real Estate

URL:
http://www.bizweb.com/keylists/real_estate.html
Comment: Biz Web's Real Estate List
Description: List of links to other real estate sites

URL: http://www.century21-santacruz.com/generalinfo.html
Comment: Century 21 - Santa Cruz
Description: General Real Estate Information

URL:
http://www.sfgate.com/classifieds/friday/Real-Estate.shtml
Comment: Classifieds Gateway Real-Estate Index
Description: Various real estate classified ads online

URL: http://www.accesscb.com/accesscb/
Comment: Coldwell Banker - Texas
Description: Coldwell Banker - Texas

URL: http://199.107.122.6/
Comment: Global Real Estate Registry Home Page
Description: Southern California based Internet real estate promoter

URL:
http://www.homesmag.odc.com/index.html
Comment: Homes Internet Magazine
Description: Residential real estate listings and information

URL: http://www.inman.com/
Comment: Inman News Features

URL:
http://www.conway.com/webidrcn.htm
Comment: International Development Reserach Council (IDRC)
Description: International Development Reserach Council (IDRC)

URL: http://www.ired.com/
Comment: IRED.COM - Home Page
Description: International Real Estate Developers
URL: http://www.lee-assoc.com/
Comment: Lee & Associates Home Page
Description:

URL: http://www.property-link.com/
Comment: Property-Link!
Description: California based Internet listing service

URL:
http://galaxy.einet.net/galaxy/Business-and-Commerce/Consumer-Products-and-Services/Real-Estate.html
Comment: Real Estate (Consumer Products and Services)

URL: http://www.realty.net/
Comment: Realty.Net!
Description: Seattle based real estate information

URL:
http://www.sanctum.com/4realestate/index.html
Comment: Home Page
Description: Assorted real estate related forums and information

URL: http://www.sior.com/
Comment: Society of Industrial and Office Realtors

URL: http://www.pmadt.com/vreal/
Comment: Web World Realty
Description: Internet based listing service

Telecommuting Studies, Research and Organizations

URL:
http://www.globaldialog.com/~morse/arevo.htm#arevo9
Comment: AREVO: Advocates for Remote Work & the Virtual Office

URL:
http://www.att.com/Telecommute_America/isource.html

Comment: AT&T's Telecommuting Information

URL: http://128.165.144.22/Group/tsa10/rick_johnson/telebenefits.html
Comment: Benefits of Telecommuting

URL: http://www.sctp.org/casestudies.html
Comment: Case Studies

URL: http://communication.sbs.ohio-state.edu/cast/
Comment: Center for Advanced Study in Telecommunications

URL: http://www.commerce.net/
Comment: CommerceNet Home
URL: http://web.mit.edu/afs/athena.mit.edu/org/c/cts/www/research/research.overview.html
Comment: CTS Research Overview

URL: http://www.planete.net/~cslucki/us/indexus.html
Comment: Cyberworkers

URL: http://128.165.144.22/Group/tsa10/rick_johnson/feasible.rpt.html
Comment: DEVELOPING A TELEWORKING CAPABILITY

URL: http://www.eff.org/pub/GII_NII/Telecommuting_telework/
Comment: EFF "GII/NII - Telecommuting & Telework" Archive

URL: http://etrg.findsvp.com/
Comment: Emerging Technologies Research from FIND/SVP, Inc.

URL: http://etrg.findsvp.com/telework/teleindx.html
Comment: FIND/SVP's 1995 Telecommuting Fact Sheet

URL: http://iitf.doc.gov/
Comment: Information Infrastructure Task Force

URL: http://policy.net/huber/
Comment: Manhattan Institute for Policy Research

Description: Manhattan Institute for Policy Research

URL: http://www.gilgordon.com/realestate.html
Comment: Real Estate and the Virtual Office

URL: http://www.nap.edu/readingroom/books/distr_work/
Comment: Research Recommendations: To Facilitate Distributed Work

URL: http://www.svi.org
Comment: Smart Valley Inc.
Description: Telecommuting information

URL: http://www.svi.org/PROJECTS/TCOMMUTE/webguide/
Comment: SMART VALLEY, INC.'S TELECOMMUTING WEB PAGES

URL: http://www.hoaa.com/main.htm
Comment: SoHo Central, Home Office Resources

URL: http://www.sctp.org/resource.html
Comment: Southern California Telecommuting Partnership Resource Library
Description: Southern California Telecommuting Partnership Resource Library

URL: http://www.metropolismag.com/archives/960301-003.html
Comment: TECHNOLOGY TRANSFORMS THE PLACES WE LIVE

URL: http://www.spp.umich.edu/telecom/telecom-info.html
Comment: Telecom Information Resources

URL: http://user.itl.net/~gazza/telecomm.htm
Comment: telecomm.htm

URL: http://www.engr.ucdavis.edu/~its/telecom/
Comment: Telecommunications and Travel Research Program

URL:
http://www.att.com/Telecommute_America/
Comment: Telecommute America!

URL:
http://www.info.gov/Info/html/telecommuting.htm
Comment: Telecommuting

URL:
http://grove.ufl.edu:80/~pflewis/commute.html
Comment: Telecommuting and Telework Info Page

URL:
http://www.cba.uga.edu/tc96/resources/articles.html
Comment: Telecommuting Articles
URL:
http://danshiki.oit.gatech.edu/telecom/telecom-home.html
Comment: Telecommuting Initiative

URL: http://www.gilgordon.com/
Comment: Telecommuting, Teleworking and Alternative Officing

URL: http://www.klr.com/klr/telenews
Comment: telenews

URL: http://www.nyworks.com/twk.html
Comment: Telework and Alternative Officing

URL:
http://www.sims.berkeley.edu/resources/infoecon/
Comment: The Information Economy

URL:
http://smartone.svi.org/PROJECTS/TCOMMUTE/TCGUIDE/
Comment: The Smart Valley Telecommuting Guide

URL:
http://www.yahoo.com/Business_and_Economy/Employment/Telecommuting/
Comment: Yahoo! - Business and Economy:Employment:Telecommuting

Transportation

URL: http://www-cta.ornl.gov/npts/1990/fat/NPTSFAT.HTM
Comment: 1990 NPTS Frequently Used Tables
Description: National Public Transportation Service

URL:
http://www.dot.gov/help/webmap.html
Comment: DOT Web Server Quick Locator

URL: http://nachos.engr.ucdavis.edu/~its
Comment: Institute for Transportation Studies
Description: UC Davis

URL: http://www.webcom.com/pcj/it-nf/itn-open.html
Comment: Planning Commissioners Journal: Info-Tech Resource Guide (no-frames)

URL: http://www.tsp.dot.gov/
Comment: Technology Sharing Program
Description:

URL: http://www.dot.gov:80/
Comment: The US Department of Transportation

URL:
http://www.bts.gov/smart/links/transportation.html
Comment: The World Wide Web Virtual Library: Transportation Page

URL:
http://www.nas.edu/trb/link/trandir.html
Comment: Transportation Directories and Internet Resources

URL:
http://dragon.princeton.edu/~dhb/organizations.html
Comment: Transportation Resources - Organizations

URL:
http://www.mtc.dst.ca.us/trb/urban/a1d0808.htm#census
Comment: TRB Committee A1D08 - Exceptional Links and Contacts

URL:
http://www.dot.gov/dotinfo/general/research/library.html
Comment: US DOT Technical Libraries and Report Catalogs